

REMARKS

Claims 7, 8, 12-17 and 20-25, all the claims pending in the application, stand rejected. Claims 7, 12, 20 and 21 are amended. New claims 26-28 are newly added.

Support for the amendment to claims 7 and 12 is provided below, in the response to the Section 112 rejection.

The amendment to claims 20 and 21 is supported by the description on page 6, lines 15 to 23 of the original specification.

New claims 26 to 28 are based on the descriptions on page 25, lines 17 to 28; page 26, lines 1 to 4; and page 28, lines 3 to 10 of the original specification. No new matter is added.

Information Disclosure Statement

The Examiner asserts that the information disclosure statement filed October 11, 2007 fails to comply with 37 CFR 1.98(a)(1), which requires the following: (1) a list of all patents, publications, applications, or other information submitted for consideration by the Office; (2) U.S. patents and U.S. patent application publications listed in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page of the list; (4) a column that provides a blank space next to each document to be considered, for the examiner's initials; and (5) a heading that clearly indicates that the list is an information disclosure statement. The Examiner notes that the information disclosure statement has been placed in the application file, but the information referred to therein has not been considered.

Applicants respectfully request reconsideration of this decision and consideration of the Information Disclosure Statement as filed, as all requirements of the cited rules have been met. A copy of the IDS as previously submitted is attached and clearly complies.

Claim Rejections – 35 U.S.C. § 112

Claims 7, 8, 12-17 and 20-25 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. This rejection is traversed for at least the following reasons.

The Examiner notes that claim 7 recites the limitation "the main surface" in lines 5, 9, and 12. The Examiner asserts that there is insufficient antecedent basis for this limitation in the claim.

The claim has been amended to remedy this basis for rejection.

The Examiner further notes that claim 12 recites the limitation "the main surface" in line 7. The Examiner asserts that there is insufficient antecedent basis for this limitation in the claim.

The claim has been amended to remove this basis for rejection.

Additionally, the Examiner notes that Applicant has provided a new limitation in both independent claims 7 and 12 which requires in part that "the etching step (is) executed so that a load is restrained in the precision polishing step and a resultant amount of a turned-down edge of the glass substrate falls within a range between -2 micrometers and 0 micrometers after the precision polishing step". The Examiner asserts that "Applicant has provided substantially no nexus linking the etching operation, the applied 'load' in the precision polishing step, and the degree of the 'turned-down edge' such that one of ordinary skill in the art would reasonably be apprised of the particular metes and bounds of the claimed invention."

The Requisite Nexus Is Present

At first, Applicants respectfully submit that an important feature of the present invention resides in that an etching step is executed in consideration of a precision polishing step carried out after the etching step so that a polishing-off amount (namely, a machining allowance for polishing) becomes small in the precision polishing step.

Degree of Polishing Off Amount

According to the present invention, the polishing-off amount in the precision polishing step is as small as 1 μ m or so (page 29, lines 18 to 19 of the original specification) while the polishing-off amount in the comparative example 2 is as large as 5 μ m (as mentioned on page 32, lines 7 to 10 of the original specification). In the present invention, such a small polishing-off amount during the precision polishing step is essential to a decrease in failures (loading failure) that occur on loading the mask blank onto a stepper of an exposure machine (see page 34, line 19 to page 35, line 1 of the original specification).

Polishing Off Amount and Turned Down Edge

Specifically, the present invention discloses a clear relationship between the polishing-off amount in the precision polishing step and an amount of a turned-down edge of the glass substrate. For example, as the polishing-off amount becomes large, the amount of the turned-down edge becomes large and, as a result, the loading failure very often takes place. From this fact, it is readily understood that a large polishing-off amount brings about a loading failure.

Under the circumstances, the polishing-off amount is preferably small in the precision polishing step in view of avoiding the loading failure but such a small polishing-off amount makes it difficult to find any defect in an inspection step. Taking this into account, the present invention also teaches a relationship between the etching step, the polishing-off amount in the polishing step, and the amount of the turned-down edge.

Polishing Off Amount and Machining Load

Applicants further note that the polishing-off amount is closely related to a machining load imposed on each glass substrate during the precision polishing step (as mentioned on page 29, lines 15 to 20 of the original specification). More particularly, when the polishing-off amount is small, the precision polishing time is shortened and the machining load imposed on each glass substrate during the precision polishing step is reduced. One skilled in the art would easily understand that this makes it possible to prevent each glass substrate from being broken during the precision polishing step.

At any rate, the etching step according to the present invention is slowly executed by the use of an alkaline aqueous solution which is weak in an etching ability and is effective not only to elicit any defect on the main surface of each glass substrate but also to leave a small polishing-off amount in the precision polishing step.

Moreover, although an etching step generally roughens a surface, the above-mentioned etching step, using an alkaline aqueous solution having a weak etching capability, is useful to prevent the surface from being roughened by an etchant and to keep the surface flat. Further, this enables a reduction in amount of polishing needed in the precision polishing step carried out after the etching step.

In conclusion, Applicants respectfully submit that the foregoing discussion clearly explains the nexus linking the etching operation, the applied “load”, and the degree of the

“turned-down edge”.

Claims 20 and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite. This rejection is traversed for at least the following reasons.

The Examiner asserts that each of the claims 20 and 21 recite the limitation wherein the polishing step is performed to provide the glass substrate with a "flatness required for a selected one of ArF excimer laser, F2 excimer laser, and EUV". The Examiner asserts that Applicant has failed to adequately define the requisite flatness, and further asserts that one of ordinary skill would not necessarily be apprised of the flatness, the particular metes and bounds for which applicant seeks patent protection are rendered unclear and indefinite.

Applicants respectfully submit that the Applicants have expressly taught at page 6 of the original specification that:

The glass substrates used for lithography of mask blank glass substrates are required to exhibit higher flatness and smoothness as exposure wavelengths become shorter (with increased miniaturization of patterns). For the exposure wavelengths of an ArF excimer laser (wavelength: 193 nm) and an F2 excimer laser (wavelength: 157 nm), the smoothness is required to be 0.2 nm or less in terms of the root mean square roughness (RMS), or 0.15 nm or less in terms of the root mean square roughness (RMS) at EUV (wavelengths of 13 to 14 nm). Under the etching conditions set forth above, the surfaces of the glass substrates are roughened, failing to meet the requirements.

On the basis of the foregoing teachings, the claims have been amended to recite a specific range of flatness.

Claim Rejections - 35 USC § 103

Claims 7, 8, 12-17, 20-24, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walker (US 2,372,536) in view of Feng (US 6,596,042 B1) and Hagihara (US 2001/0051746 A1). This rejection is traversed for at least the following reasons.

Walker

In Walker, a fine grinding operation of a stock piece (illustrated in Fig. 3) is executed.

Clearing Process

After the fine grinding operation, the stock piece is subjected to intermediate treatments of the stock piece (chemical clearing) by means of a glass-reactive chemical agent (page 3, left

column, lines 23 to 25), as shown in Fig. 4. Such a chemical process serves to clear the ground glass surfaces of particles or debris remaining from the grinding process and to round off acute angle formations of cusps and so on (page 3, left column, lines 25 to 28; page 4, left column, lines 18 to 31).

In the chemical clearing step, any relatively deep surface scratches or other marks are readily discernible (page 3, right column, lines 33 to 35). Thus, the stock piece may be inspected at this stage to locate any such defects. If the piece is found to contain undesirable imperfections, the stock piece may be discarded (page 3, lines 35 to 40).

Notably, in Walker the chemical clearing step is carried out by using a mixture of hydrofluoric acid and sulfuric acid in water (page 3, right column, line 50). Also, the chemical clearing step is carried out after the grinding step. As would be well understood by one skilled in the art, the grinding step is different from a fine polishing step, which is conducted subsequently. Specifically, a roughened surface is left after the grinding step, as compared with a polishing step.

This means that etching such a roughened surface would be quickly carried out in the chemical clearing step by using the mixture of hydrofluoric acid and sulfuric acid that would be strong in an etching ability. Otherwise, a ground surface, which is substantially rougher than a polished surface could not be practically cleared in the manner mentioned in Walker.

Fine Polishing

After the chemical clearing step, the stock piece has a series of relatively low domes or wave-like formations indicated at 30 (page 3, right column, lines 21 to 26). If the stock piece withstands inspection at this stage, it is subjected to a fine polishing action by means of rouge or other suitably fine abrasive under a rapidly moving lap whereby the wavy formation of the surface illustrated in Fig. 4 will be completely reduced to perfectly regular form as illustrated at 32 in Fig. 5 (page 3, right column, lines 43 to 46).

At any rate, there is no disclosure at all in Walker about etching a roughly polished surface prior to a precision polishing step in consideration of a polishing-off amount in the precision polishing step so as to reduce the polishing-off amount and the resultant turned-down amount in the precision polishing step. Moreover, using the mixture of hydrofluoric acid and sulfuric acid in the etching roughens the surface of the stock piece in Walker and, as a result, a

machining allowance for polishing (polishing-off amount) becomes inevitably large. This results in a large amount of turned-down edge of the stock piece and causes failure when loading the stock piece onto other devices, such as a stepper or so, as described in the original specification.

Thus, Walker suggests neither (1) the necessity of reducing a polishing-off amount in a precision polishing step nor (2) the desirability of solving a loading failure problem of stock pieces. In addition, Walker does not teach any means for reducing the loading failure to the other devices. Furthermore, an inspecting step is not executed in Walker after the final polishing step because an imperfect stock piece is discarded before the final polishing step. Finally, as mentioned in the original specification (page 27, lines 21 to 26), since an etched stock piece has texture irregularities or wavy formation on a surface (see Fig. 4 in Walker) after etching, cracks are often hidden behind the texture irregularities and are overlooked.

For all the foregoing reasons, Walker is fundamentally deficient in teaching basic features of the present invention. The subsidiary prior art does not remedy these deficiencies.

Feng et al

Feng et al discloses a process for producing particles suitable for use as abrasives in chemical-mechanical polishing slurries. However, there is no teaching at all in Feng et al of any machining that is relevant to the claimed invention, namely (1) any problem peculiar to a glass substrate for a mask blank or (2) any relationship between an etching step and a polishing step.

Hagihara et al

Hagihara et al simply teaches a roll-off reducing agent, which is capable of reducing roll-off of a polished substrate caused by polishing. The agent disclosed by Hagihara et al serves to increase a polishing rate (0008). This means that no consideration is made at all in Hagihara et al about loading failure resulting from a reduction of a roll-off.

Claims 7, 12 and 26-28

In marked contrast, the present invention, as defined by amended claims 7 and 12, and new claims 26 to 28, requires etching of the main surface prior to the precision polishing step and the inspection step, in consideration of the polishing-off amount in the precision polishing step and the resultant amount of the turned-down edge.

To this end, the etching step is slowly carried out, according to new claim 27 to elicit any defect by the use of the alkaline aqueous solution which is weak in the etching ability.

Accordingly, Applicants respectfully submit that amended claims 7 and 12, and new claims 26 to 28, are not obvious from Walker, Feng, and Hagihara et al together with the remaining dependent claims and are patentable over them.

Claims 8, 13-17 and 20-25

These claims would be patentable for the reasons given for parent claims 7 and 12, respectively.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

/Alan J. Kasper/

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

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CUSTOMER NUMBER

Alan J. Kasper
Registration No. 25,426

Date: June 11, 2008